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NCEL Techdata Sheet

Determine Seafloor Soil Properties With Diver Operated Geotechnical Tools

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This Techdata Sheet is primarily directed to ocean engineers who are tasked with determining the geotechnical properties of seafloor soils. It reports the development and stocking of six new diver operated tools: an Impact Corer, a Miniature Standard Penetration Test tool, a Vane Shear device, a Rock Classifier, a Jet Probe, and a Vacuum Corer.

A set of six geotechnical diver tools has been developed to provide military divers with the capability to gather marine geotechnical (seafloor soil) data. Up to now, divers have had to use makeshift methods to try to gather information on seafloor soils. The data that can be gathered with this new set of tools can be used by military divers and engineers for site selection; calculating object embedment depths and breakout forces; designing anchoring systems and calculating anchor holding capacities; designing foundations for structures in the marine environment such as piers, sewer outfalls, pipelines, and various other structures; and the design of any device that will interact with the seafloor.

NAVAL CIVIL ENGINEERING LABORATORY PORT HUENEME CALIFORNIA 93043

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The set of geotechnical diver tools is a self-contained system consisting of the following six tools packaged in four kit boxes:

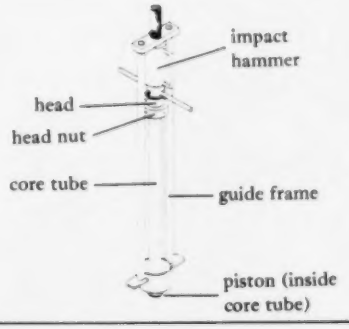
Box 1:	impact corer kit (265 lb, 16 ft^3)
Box 2:	MSPT (Miniature Standard Penetration Test) tool kit vane shear tool kit (146 lb, 11.3 ft^3)
Box 3:	rock classifier kit (147 lb, 11.3 ft^3)
Box 4:	jet probe kit vacuum corer kit (450 lb, 32 ft^3)

These kit boxes can be transported by military or commerical aircraft, truck, or ship. The kits contain spare and repair parts, support equipment, and an operation and maintenance manual. Only gasoline (fuel for the jet probe/vacuum corer pump) and a source of fresh water for after use tool cleanup are needed at the site. Two complete sets of the geotechnical diver tools are available for check-out from the Ocean Construction Equipment Inventory (OCEI) maintained by Chesapeake Division of NAVFAC.

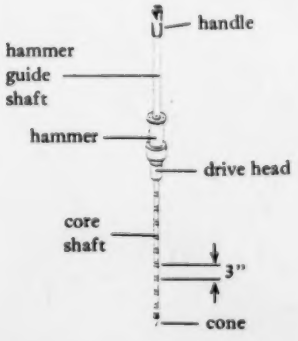
The geotechnical diver tools are designed to be hand-operated by divers wearing wetsuits and three-fingered wetsuit gloves. The tools can be operated from a beach, pier, or diving support craft. The tools are constructed of materials that are compatible with the seawater environment and they can be operated in water depths from 0 to 130 feet and water temperatures from 28 to 90°F.

Each tool is briefly described below.

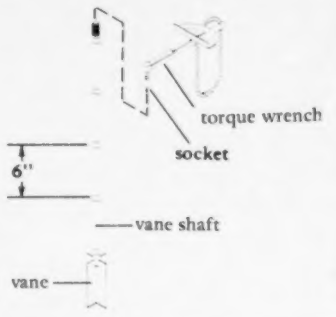
IMPACT CORER — This tool takes a soil sample (core) up to 30 inches long and 1.5 inches in diameter in a clear Lexan plastic core tube. This core tube is supported by a frame which also contains a built-in impact hammer to drive the core tube into the soil. This corer has a piston in the core tube designed to stay at the seafloor surface and create a suction in the tube to help retrieve a relatively undisturbed soil sample. The core is sealed in the core tube and can be shipped to a geotechnical laboratory for testing. The tool is 47 inches long and weighs 16 pounds in seawater.



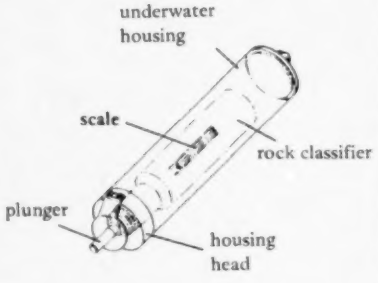
MSPT (Miniature Standard Penetration Test) — This tool takes in-situ geotechnical data in cohesionless soils (sands). The tool consists of a shaft with a cone tip at the bottom and a hammer on a guide shaft on the top. The cone tip is set on the seafloor and the hammer raised to the top of the guide shaft. The hammer is then allowed to free-fall. The number of such hammer blows per 3-inch increment of penetration is counted. The hammer blow counts can be related to relative density. Data can be taken to a depth of 30 inches. The tool is 39 inches long (stored), 68 inches long extended, and weighs 14 pounds in seawater.



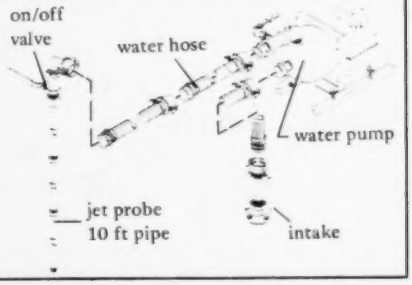
VANE SHEAR – This tool takes in-situ data in cohesive (clay-like) soils. The tool consists of three sizes of vanes attached to 30-inch shafts and a torque wrench that attaches to the top of the vane shafts. The torque wrench is used to rotate the vane in the soil until the soil fails in shear. The torque (in.-lb) required to cause this failure is measured and converted to vane shear strength (psi) through an equation. Data can be taken to a depth of 30 inches. The tool is 34 inches long and weighs 10 pounds in seawater.



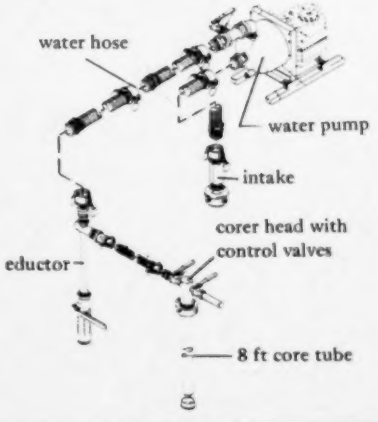
ROCK CLASSIFIER – This tool produces data on the surficial strength of rock. The tool is a standard rock classifier used on land that has been fitted into an underwater housing. The rock classifier works by pressing a plunger against the rock surface; an internal hammer strikes and rebounds from the plunger. A rebound number is read off the classifier's scale and is related to axial compressive strength and the tangent modulus of the rock through charts. The tool is 19 inches long and weighs 3 pounds in seawater.



JET PROBE – This tool is used to determine sediment thickness by probing the seafloor to locate bedrock or other hard layers. It can also be used to verify subbottom profiler data. The tool consists of a 10-foot length of pipe with an on/off valve attached to a waterpump by 150 feet of waterhose. The tool is 11 feet long and weighs 15 pounds in seawater. The waterpump weighs 43 pounds.



VACUUM CORER – This tool takes an 8-foot core, 1.5 inches in diameter, that is fairly disturbed (due to the effect of the vacuum). The tool consists of an 8-foot clear Lexan plastic core tube and corer head attached to an eductor by a vacuum hose. Water is pumped through the eductor to create a suction in the vacuum hose and core tube. The vacuum helps the core tube penetrate the seafloor and allows divers to take an 8-foot core. The core can be sealed in the core tube and sent to a geotechnical laboratory for analysis. The type of analysis that can be done is limited by the amount of disturbance. The tool is 9 feet long and weighs 18 pounds in seawater.



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